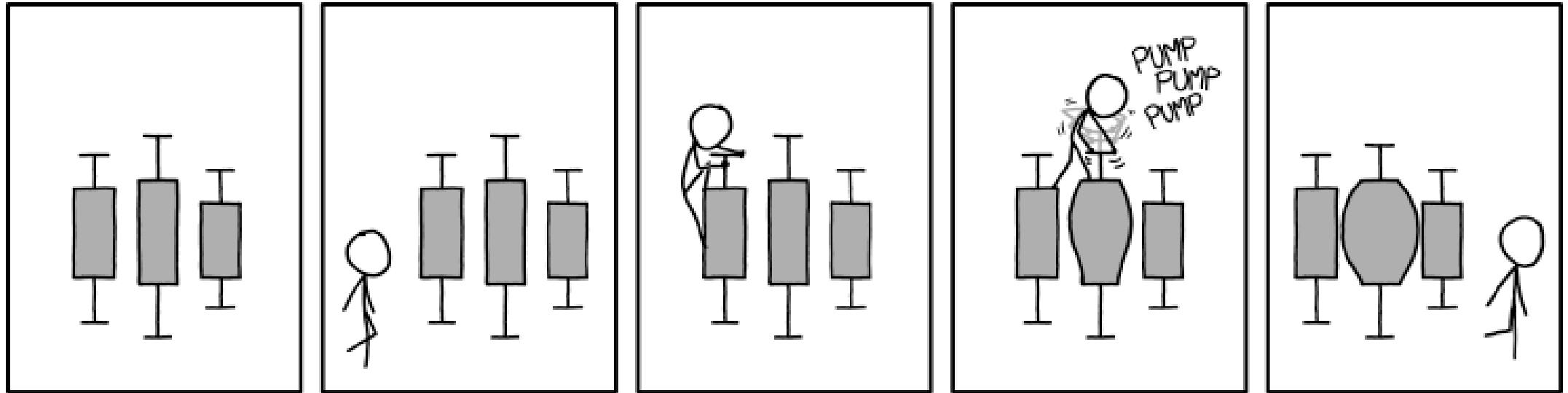


# Make Better Charts



It's not enough to collect data.

You also need to effectively convey it.

# Learning Outcomes

1. Participants will be able to choose the right chart for their message and type of data
2. Participants will be able to make good design decisions to highlighting what's important and eliminating excess information

# Learning Outcomes

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*Focusing on the very basics for a good foundation*

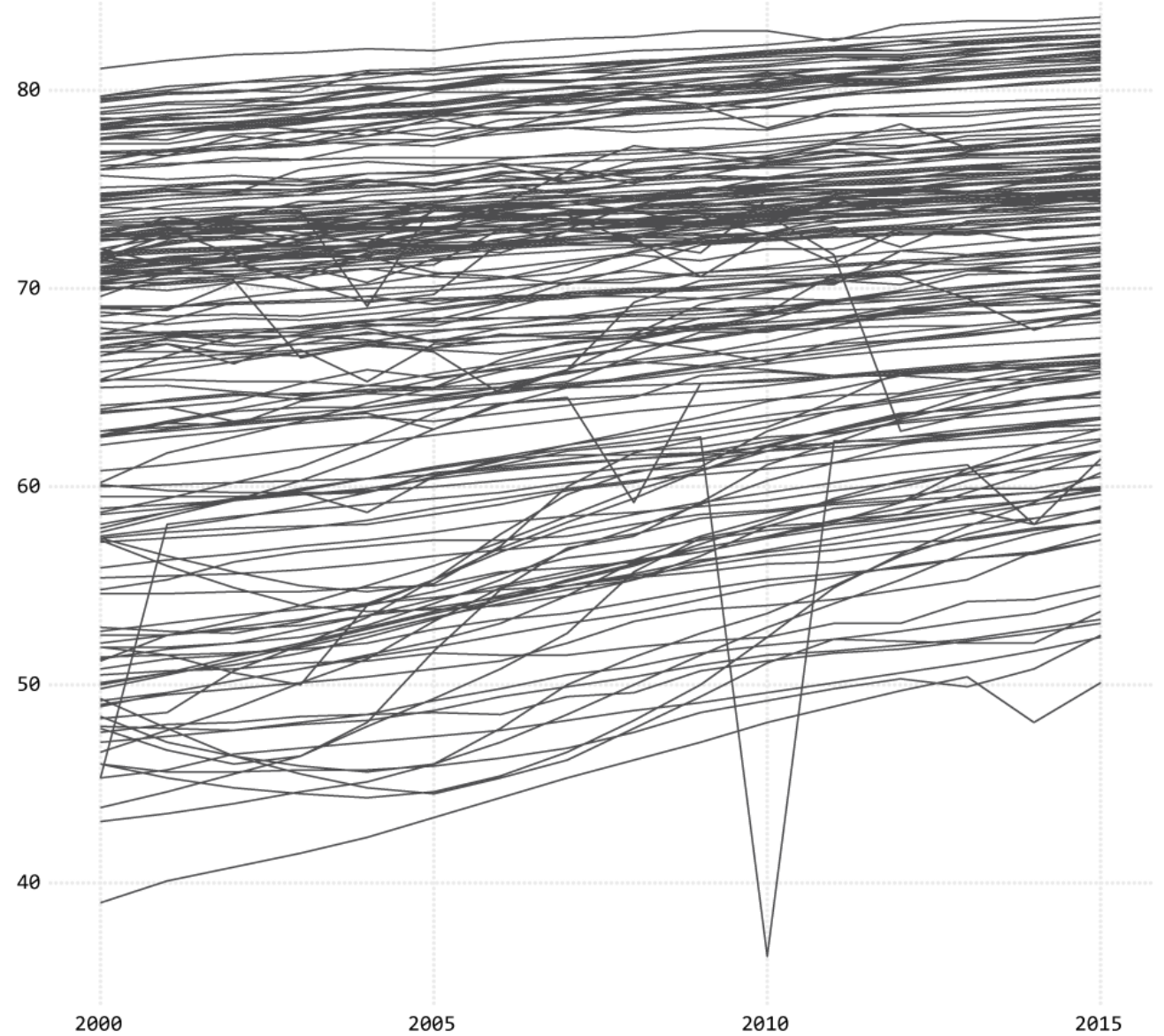
Choose the Right Chart



What is your  
message?

# Same Data Different Charts

LIFE EXPECTANCY AT BIRTH, 2000-2015  
Each line represents a country.



# Same Data Different Charts

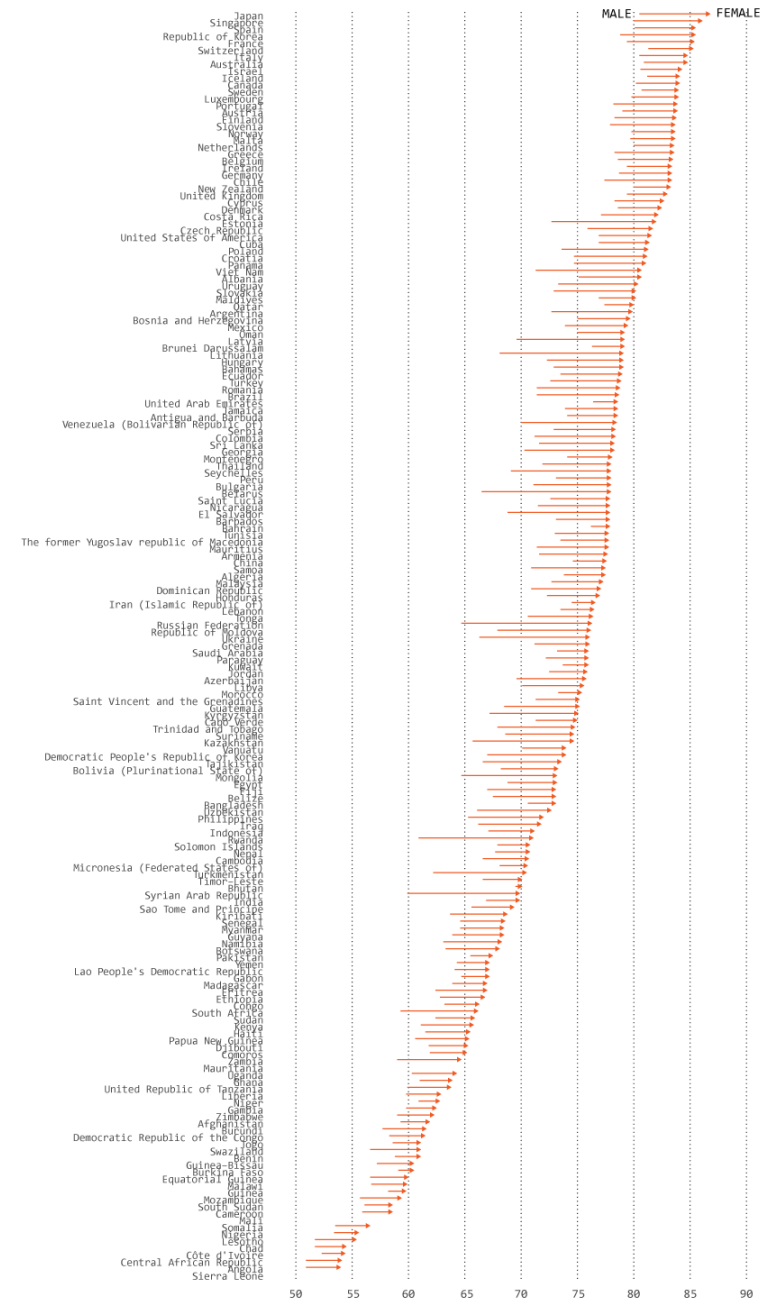
LIFE EXPECTANCY AT BIRTH, 2000-2015



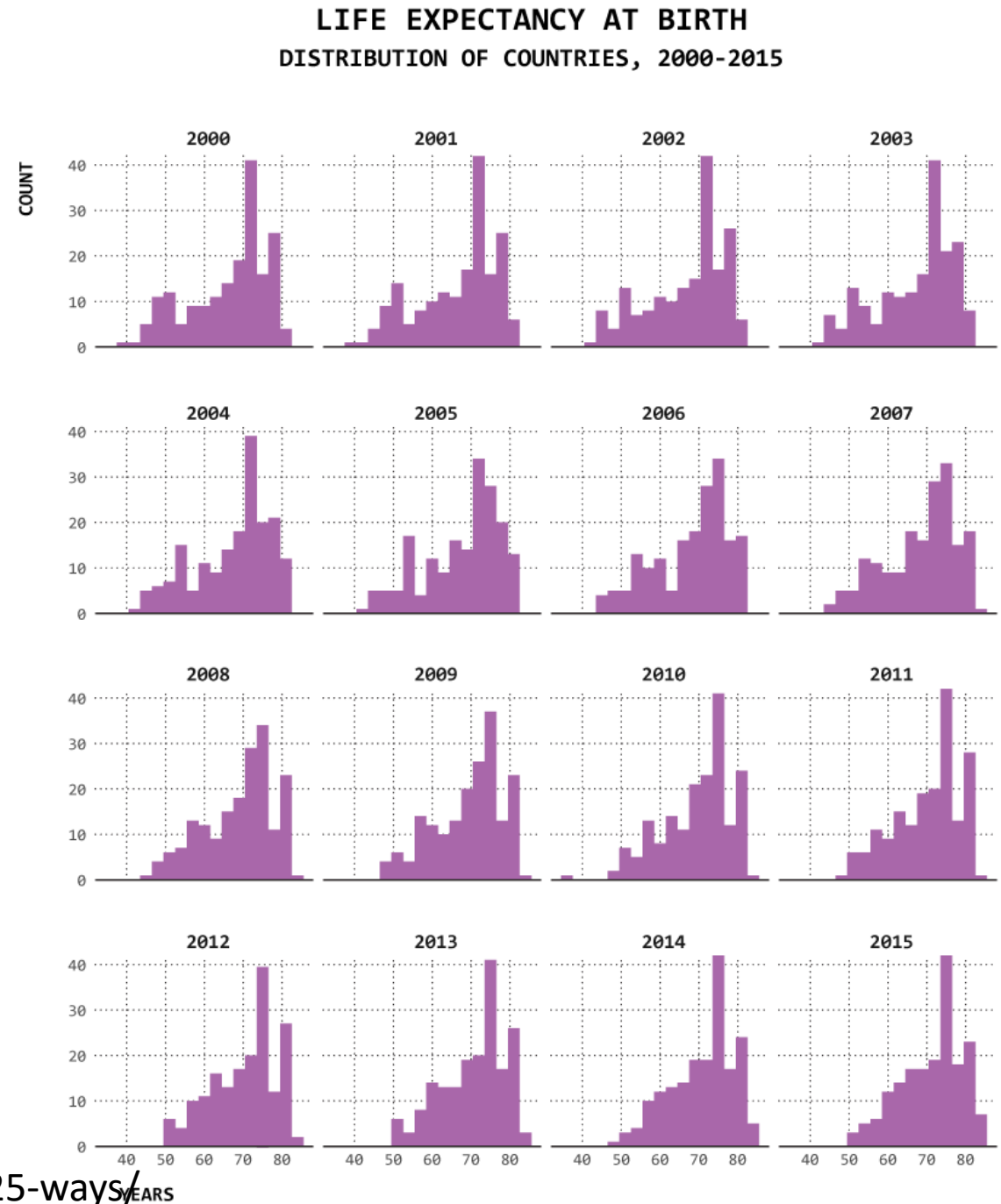


# Same Data Different Charts

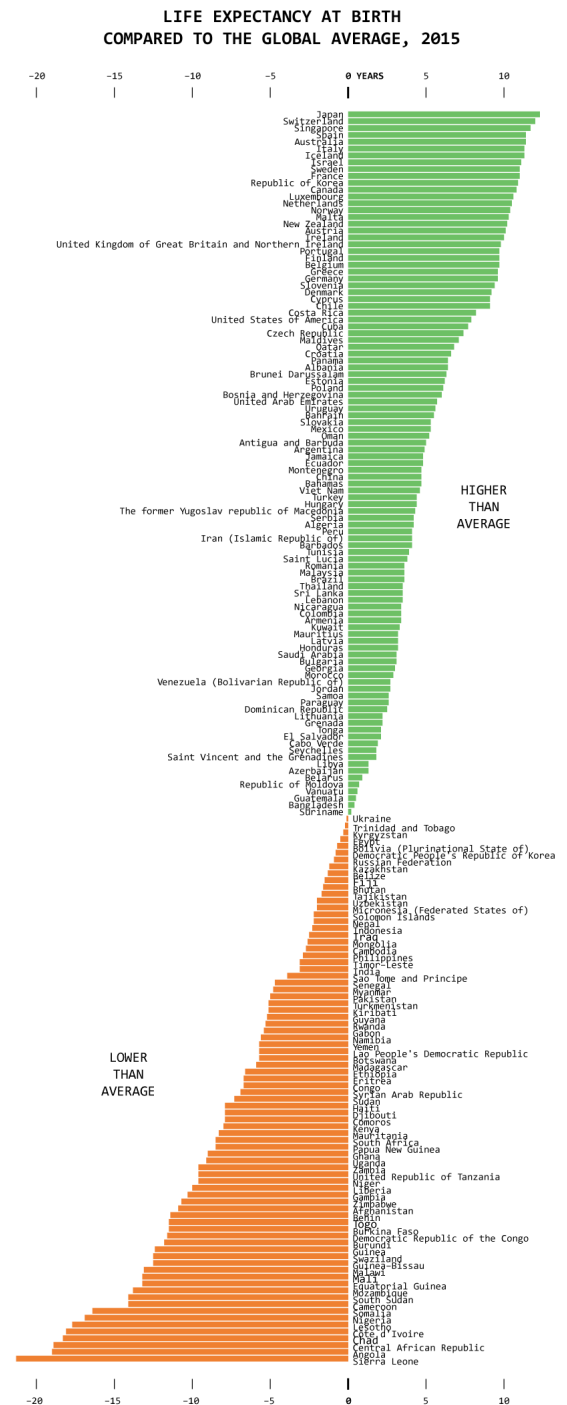
LIFE EXPECTANCY AT BIRTH  
FOR MALES AND FEMALES, 2015



# Same Data Different Charts



# Same Data Different Charts





What is your  
message?



What is your  
message?

*Hint: make it the title of your chart*

# Let's Break it Down by Your Type of Data

A single number

Comparison

Beating a benchmark

Survey results

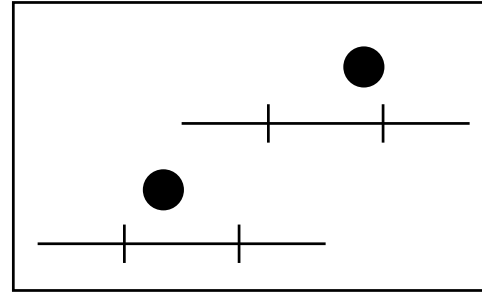
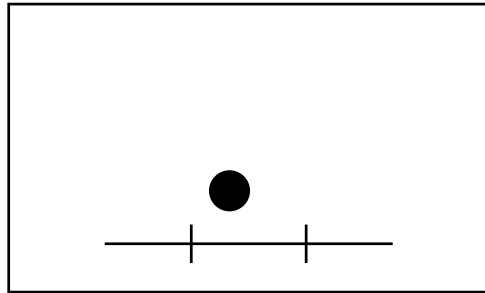
Parts of a whole

Correlations

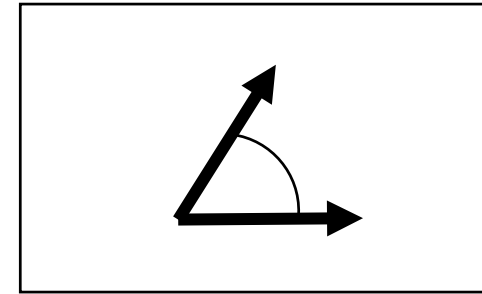
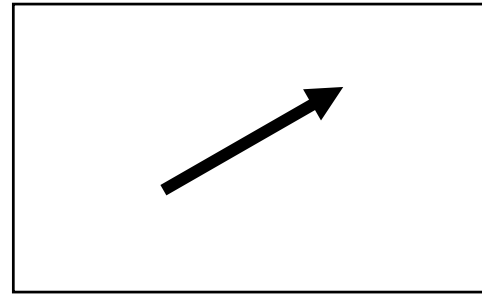
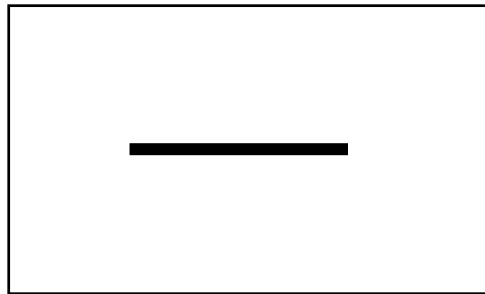
Change over time

Qualitative data [not covered]

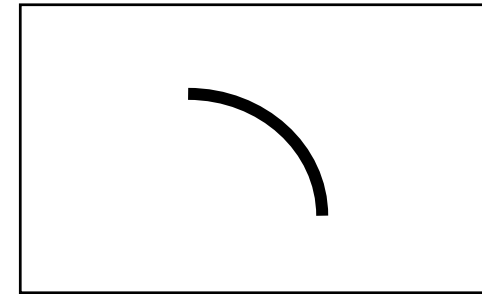
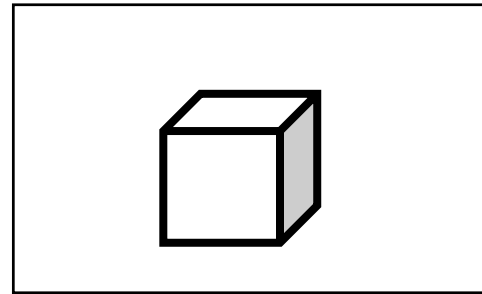
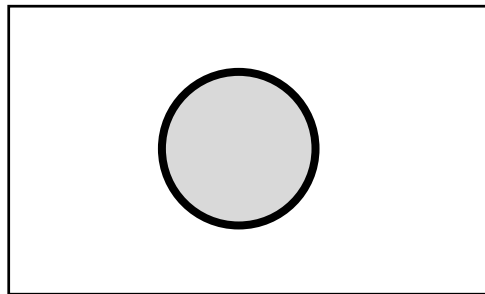
# Research Says The Best Charts Are...



Position on common scale  
Position on non-aligned scales



Length  
Direction  
Angle



Area  
Volume  
Curvature

Adapted from Evergreen, S. D. H. (2017). *Effective data visualization: The right chart for the right data.*

# Choose Your Chart

	Big number <sup>1</sup>	Icon array <sup>2</sup>	Pie chart	Bar/column chart	Side-by-side column chart	Slope graph <sup>3</sup>	Back-to-back bar chart <sup>4</sup>	Dot plot <sup>5</sup>	Small multiples <sup>6</sup>	Column chart with benchmark <sup>7</sup>	Combo chart <sup>8</sup>	Stacked bar/column chart	Number and icon	Histogram <sup>9</sup>	Map	Scatterplot	Diagram	Line chart	Deviating bar chart	Do not visualize
Single number	X	X	X	X																
Comparison					X	X	X	X	X											
Beating a benchmark										X	X									
Survey results			X	X			X		X			X	X							
Parts of a whole			X									X		X	X					
Correlations																X	X			X
Change over time						X		X				X						X	X	

Adapted from Evergreen, S. D. H. (2017). *Effective data visualization: The right chart for the right data.*



# Non-Standard Charts

# Introducing...

1. Big number
2. Icon array
3. Slope graph
4. Back-to-back bar chart
5. Dot plot
6. Small multiples
7. Column chart with benchmark line
8. Combo chart
9. Histogram

# Big Number

## CASES OF MEASLES IN THE LAST YEAR

058

58 cases occurred  
in just two **Brooklyn,**  
**NY** neighborhoods

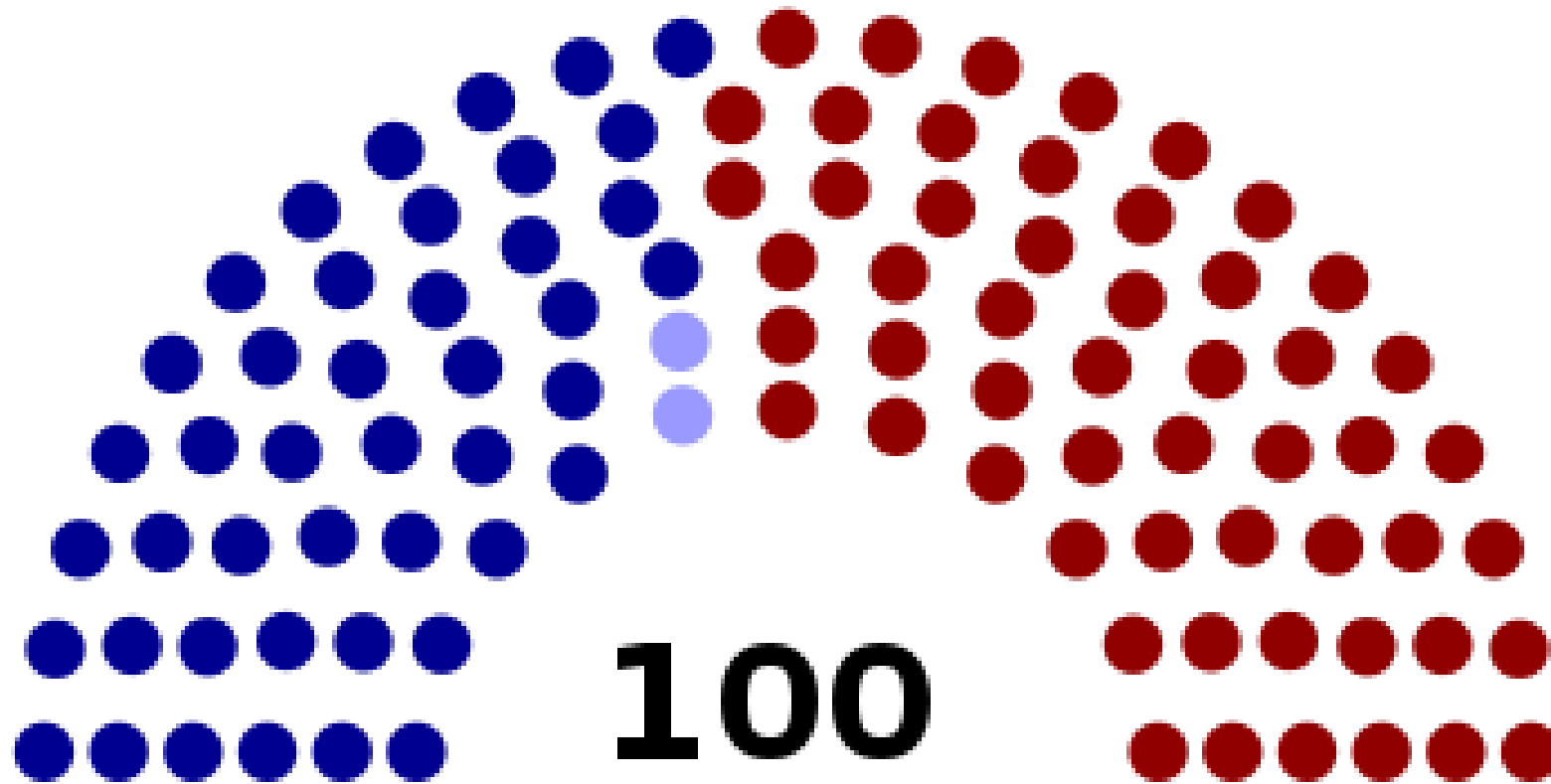
Population: **250,000**

200

There were 200 total  
cases of measles in  
the **United States**

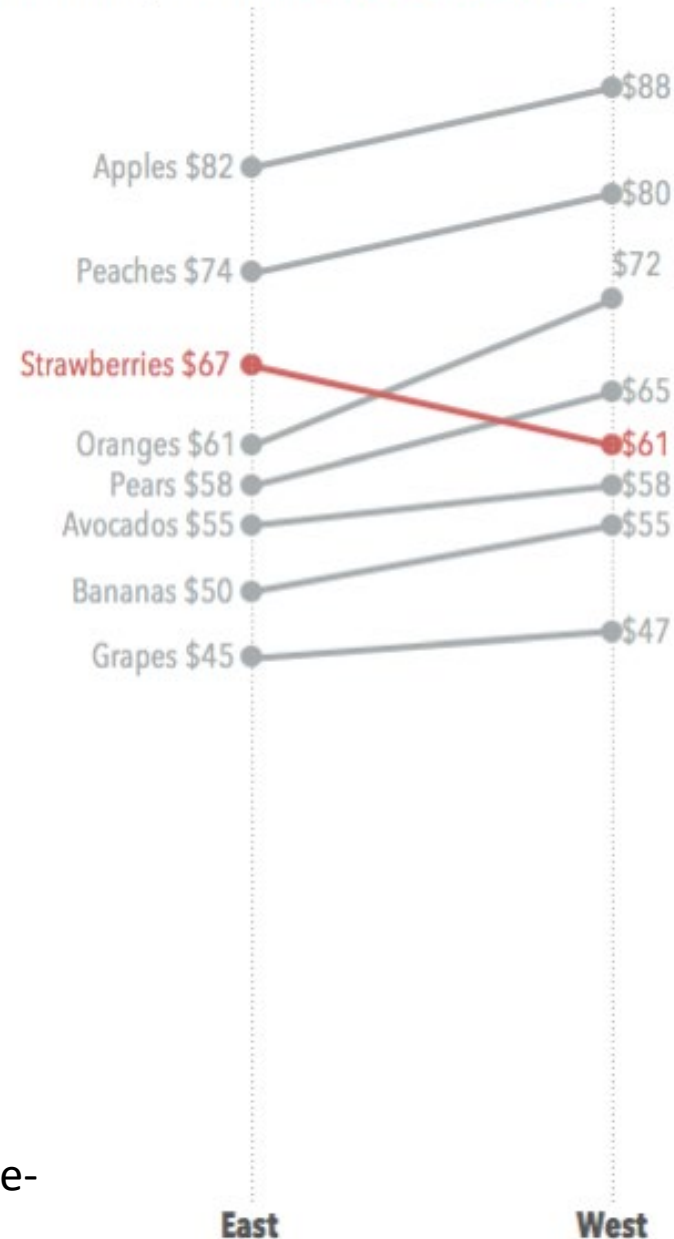
Population: **317,000,000**

# Icon Array

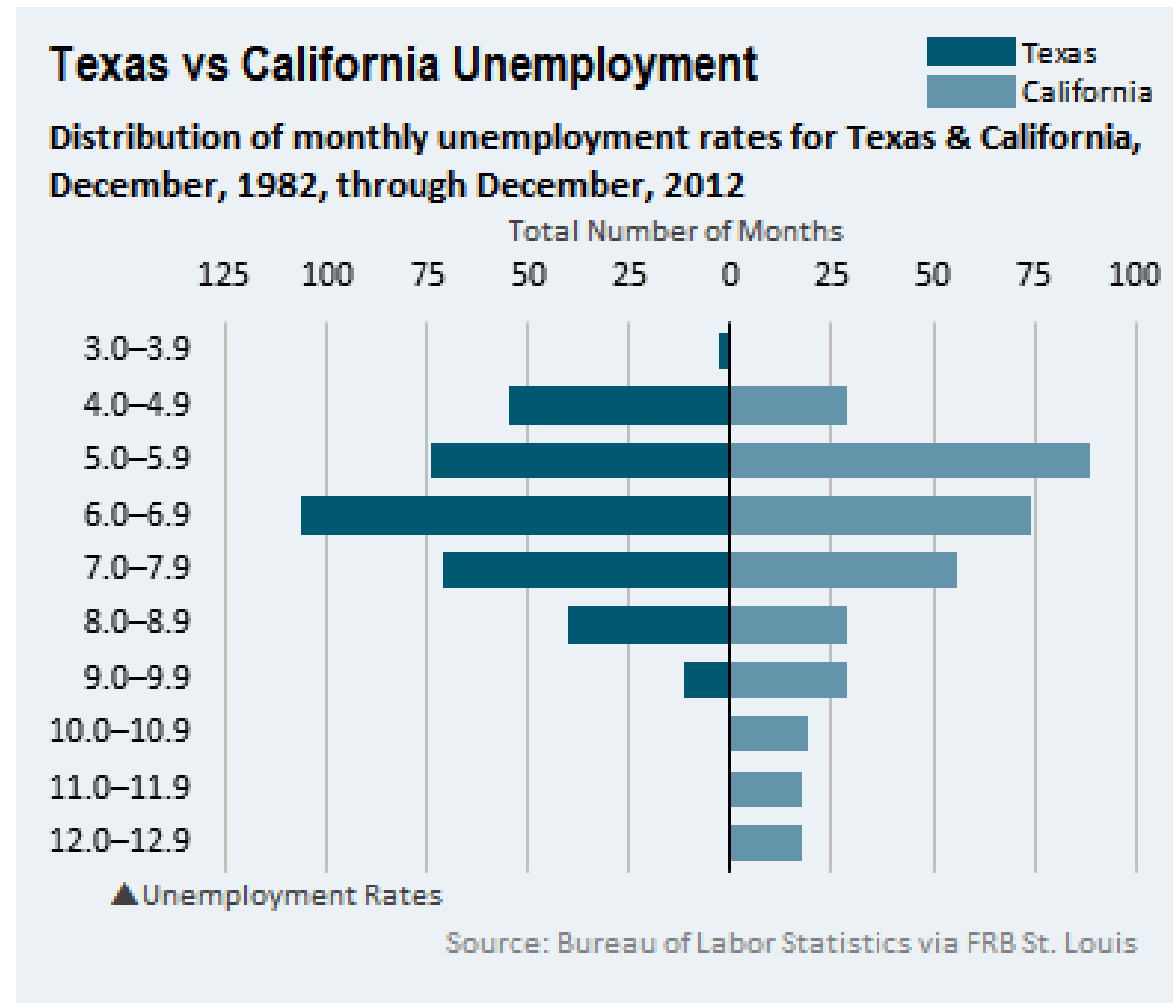


# Slope Graph

Sales are higher for nearly every fruit in the West region, with the exception of **Strawberries**.



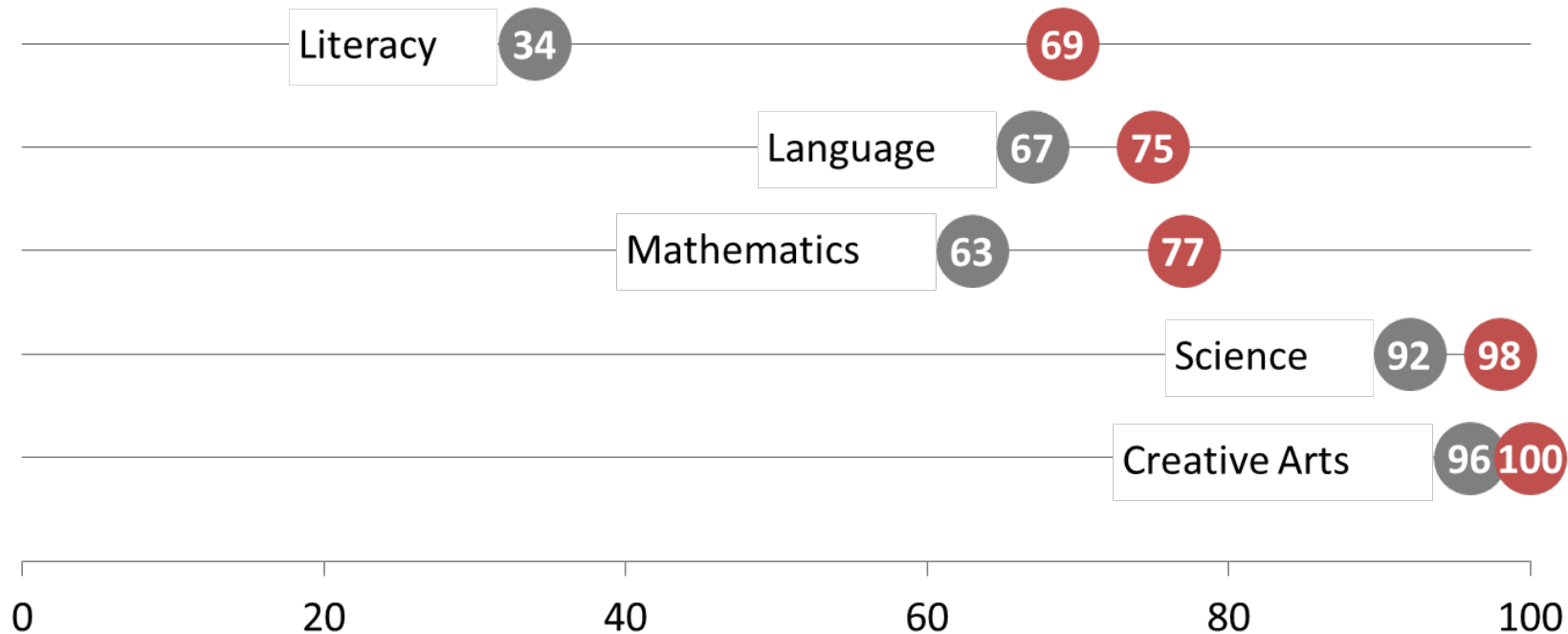
# Back-to-Back Bar Chart



# Dot Plot

**Kindergarten readiness increased between  
Fall and Spring.**

Minimum entry requirement: 65% in all areas.



# Small Multiples

LIFE EXPECTANCY AT BIRTH, 2000-2015

6



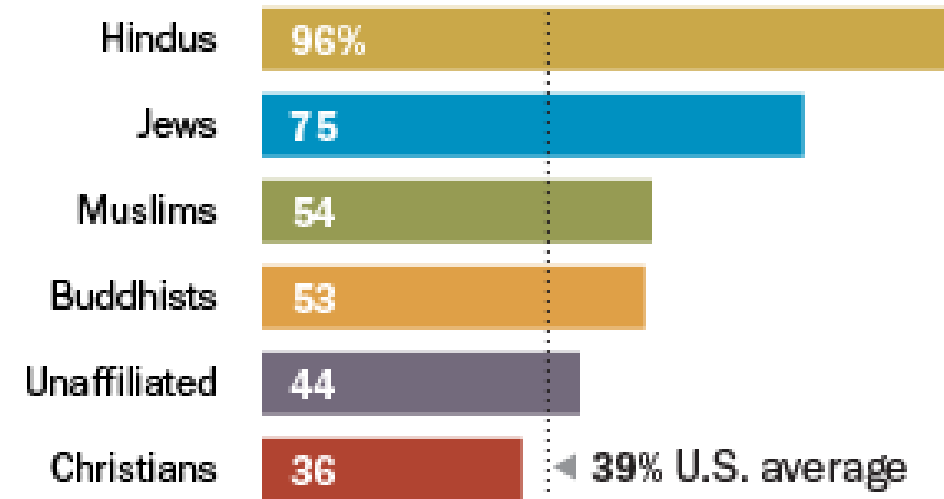


# Bar Chart with Benchmark Line

7

**In United States, religious minorities more likely to have college degrees than Christian majority**

*% with higher education, by religion*



Note: Adults ages 25 years and older as of 2010 (or latest year available).

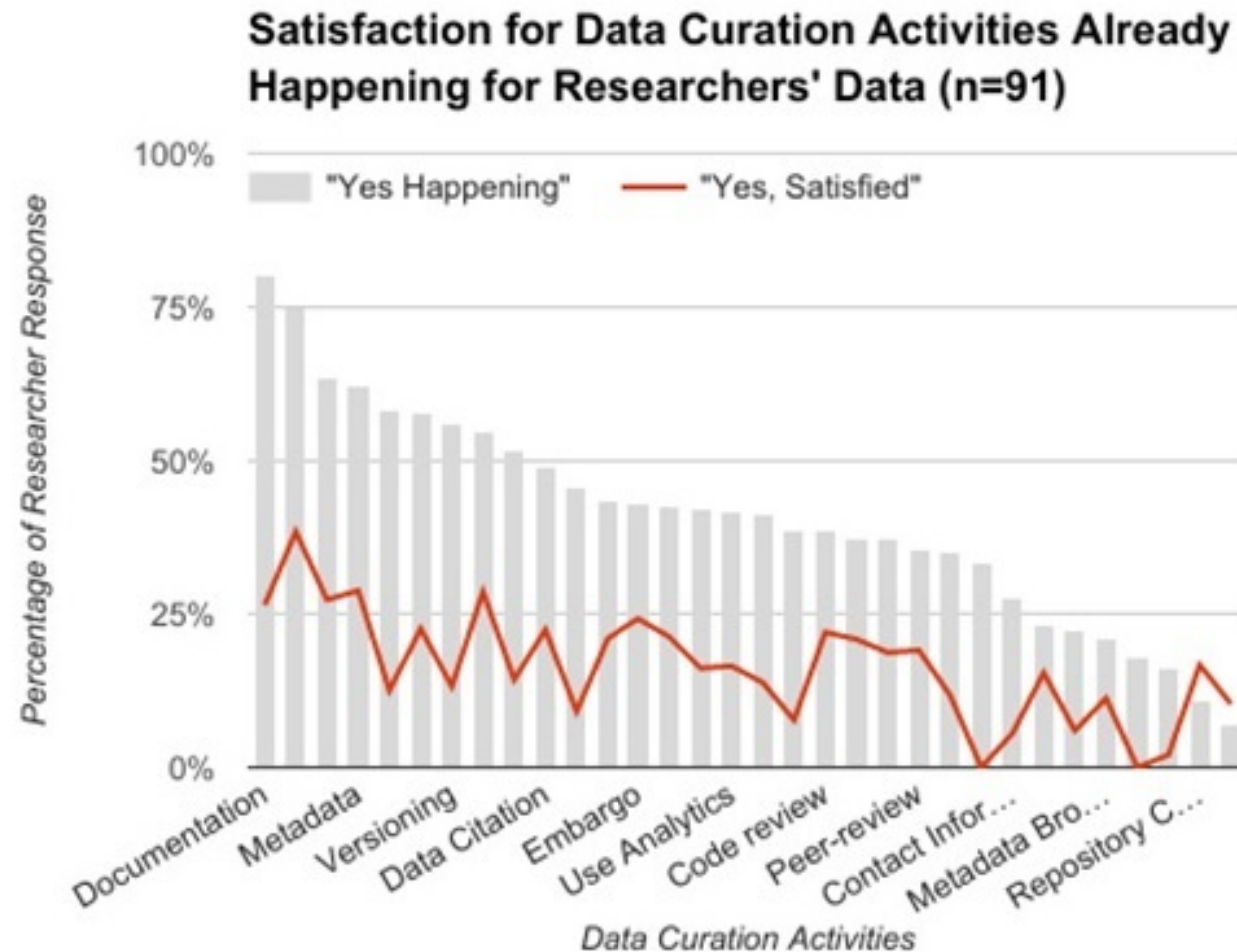
Source: Pew Research Center analysis.

See Methodology for more details.

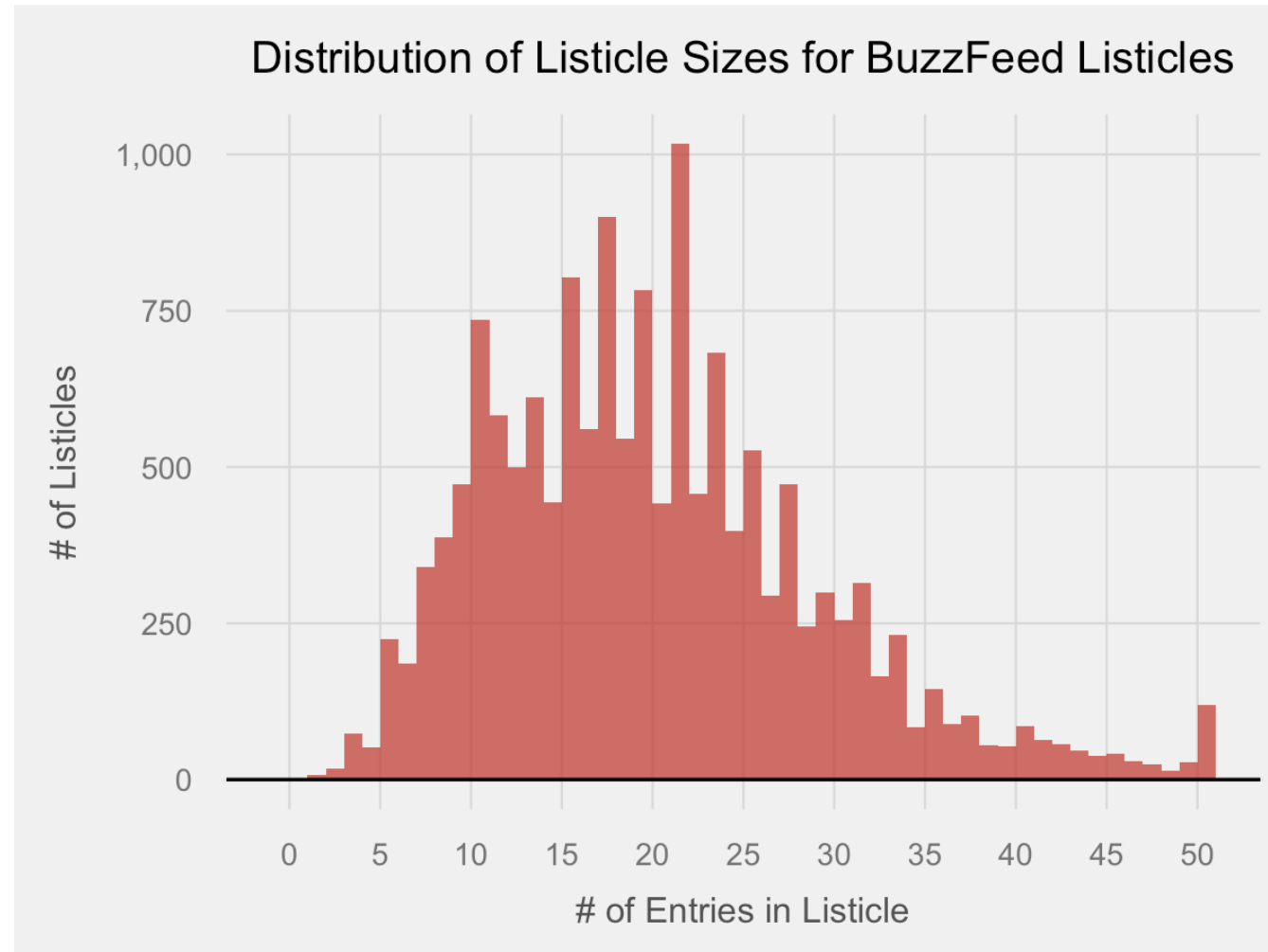
"Religion and Education Around the World"

PEW RESEARCH CENTER

# Combo Chart



# Histogram



# Activity 1

Americans and Privacy: Concerned, Confused and Feeling Lack of Control Over Their Personal Information  
*% who say they feel \_\_\_ control over who can access the following types of their information*

	<i>A lot</i>	<i>A little</i>	<i>No</i>
<i>Private conversations online, text messaging</i>	13	49	37
<i>Purchases made online, in person</i>	12	43	45
<i>Search terms they use online</i>	9	39	48
<i>Their physical location</i>	18	54	28
<i>Their posts, activities on social media</i>	16	50	35
<i>Websites they visit</i>	10	44	41

# Activity 1

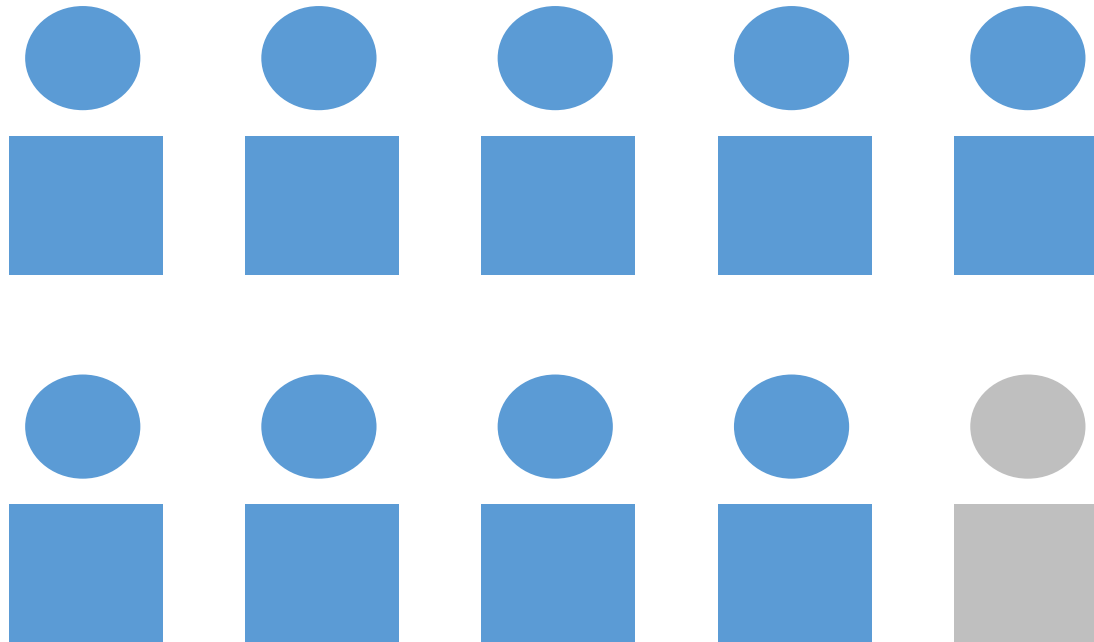
- 1. What is your message?
- 2. What type of data do you have?
- 3. What type of chart will you use?
- 4. Draw a preliminary sketch

DATA	A lot	A little	No
Private conversations online, text messaging	13	49	37
Purchases made online, in person	12	43	45
Search terms they use online	9	39	48
Their physical location	18	54	28
Their posts, activities on social media	16	50	35
Websites they visit	10	44	41

CHART TYPE	Big number <sup>1</sup>	Icon array <sup>2</sup>	Pie chart	Bar/column chart	Side-by-side column chart	Slope graph <sup>3</sup>	Back-to-back bar chart <sup>4</sup>	Dot plot <sup>5</sup>	Small multiples <sup>6</sup>	Column chart with benchmark <sup>7</sup>	Combo chart <sup>8</sup>	Stacked bar/column chart	Number and icon	Histogram <sup>9</sup>	Map	Scatterplot	Diagram	Line chart	Deviating bar chart	Do not visualize
Single number	X	X	X	X																
Comparison					X	X	X	X	X											
Beating a benchmark										X	X									
Survey results			X	X			X		X			X	X							
Parts of a whole			X									X		X	X					
Correlations																X	X			X
Change over time						X		X				X						X	X	

# Activity 1

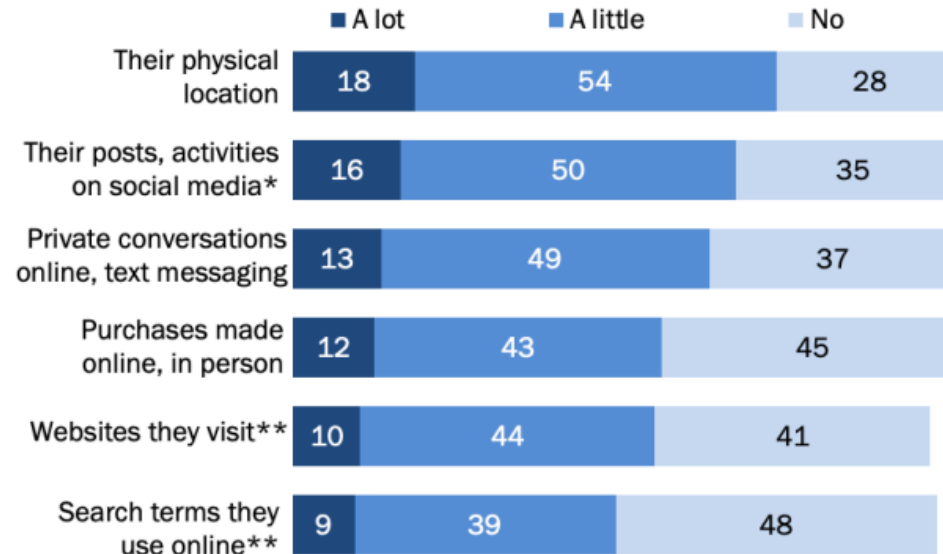
9 out of 10 American say they have little to no control over who can access the search terms they use online



# Activity 1

## About half of Americans feel as if they have no control over who can access their online searches

*% who say they feel \_\_\_ control over who can access the following types of their information*



\* Based on social media users.

\*\* Based on internet users.

Note: Respondents were randomly assigned questions about how much control they feel they have over who can access different types of their information. Those who did not give an answer are not shown.

Source: Survey of U.S. adults conducted June 3-17, 2019.

"Americans and Privacy: Concerned, Confused and Feeling Lack of Control Over Their Personal Information"

PEW RESEARCH CENTER

# Chart Design



# Reduce Cognitive Load

- People can only hold about 3 things in our working memory at one time

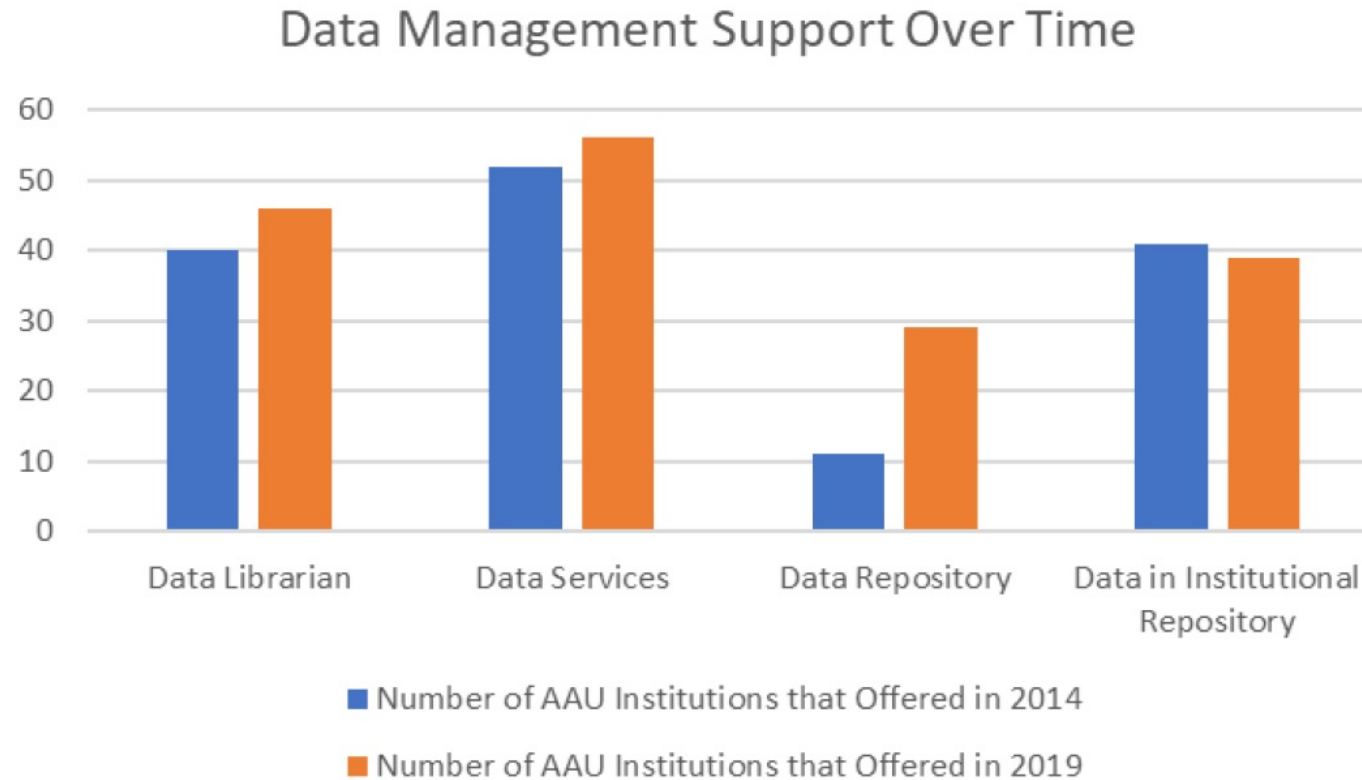
# Reduce Cognitive Load

- People can only hold about 3 things in our working memory at one time
- Readable charts highlight key information, suppress (or delete) other information, and are visually easy to scan
  - Easy to scan doesn't necessarily mean simple
  - People read charts in a Z pattern starting at the top left

# Strategies to Reduce Cognitive Load

1. Identify what is important
2. Remove chart junk
3. Draw the viewer's eye
4. Be consistent

# Example Figure

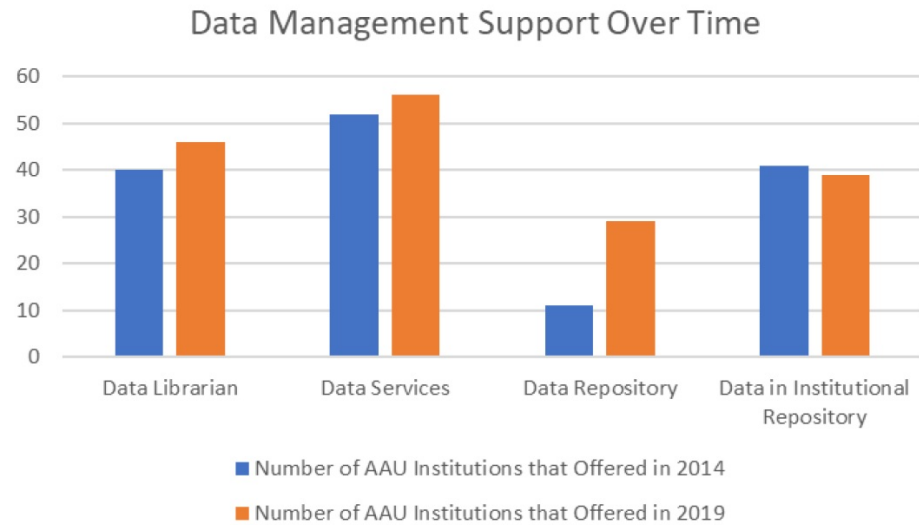


**Figure 1.** Data Staff and Service Comparison from 2014 to 2019

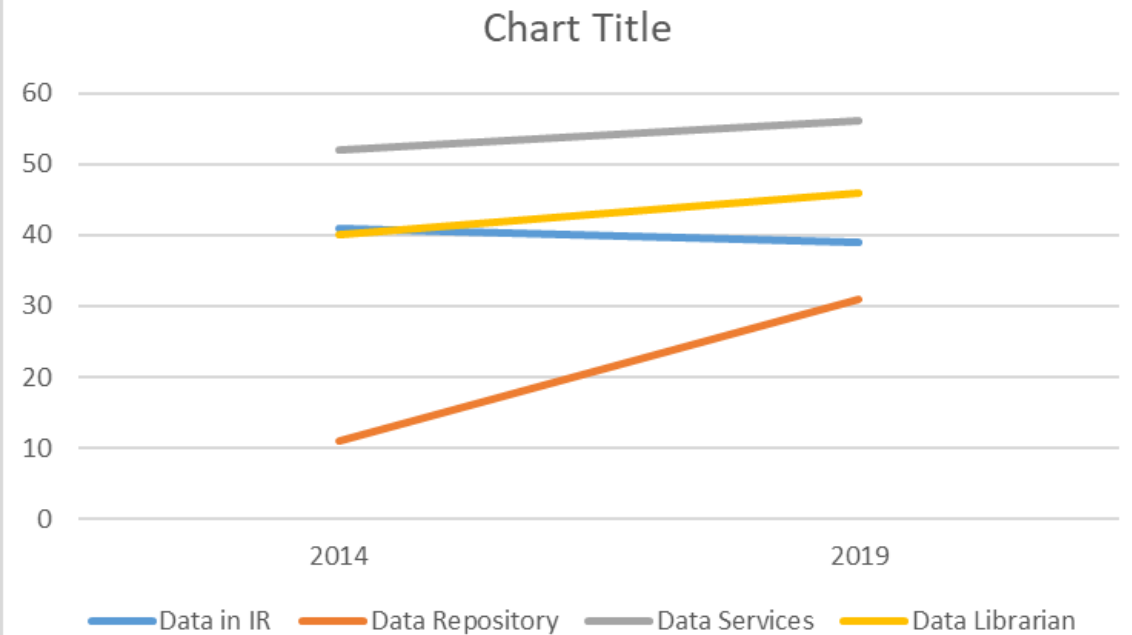
# What is My Message?

- University library data support increased from 2014 to 2019

# Change Chart Type

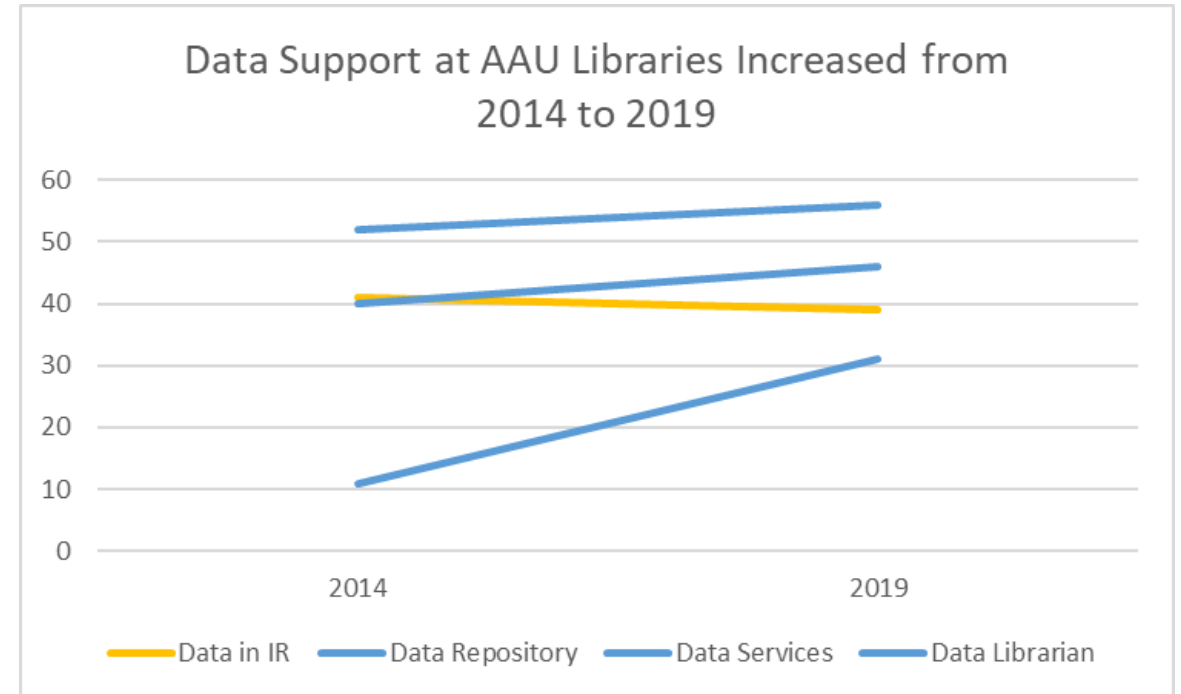


**Figure 1.** Data Staff and Service Comparison from 2014 to 2019



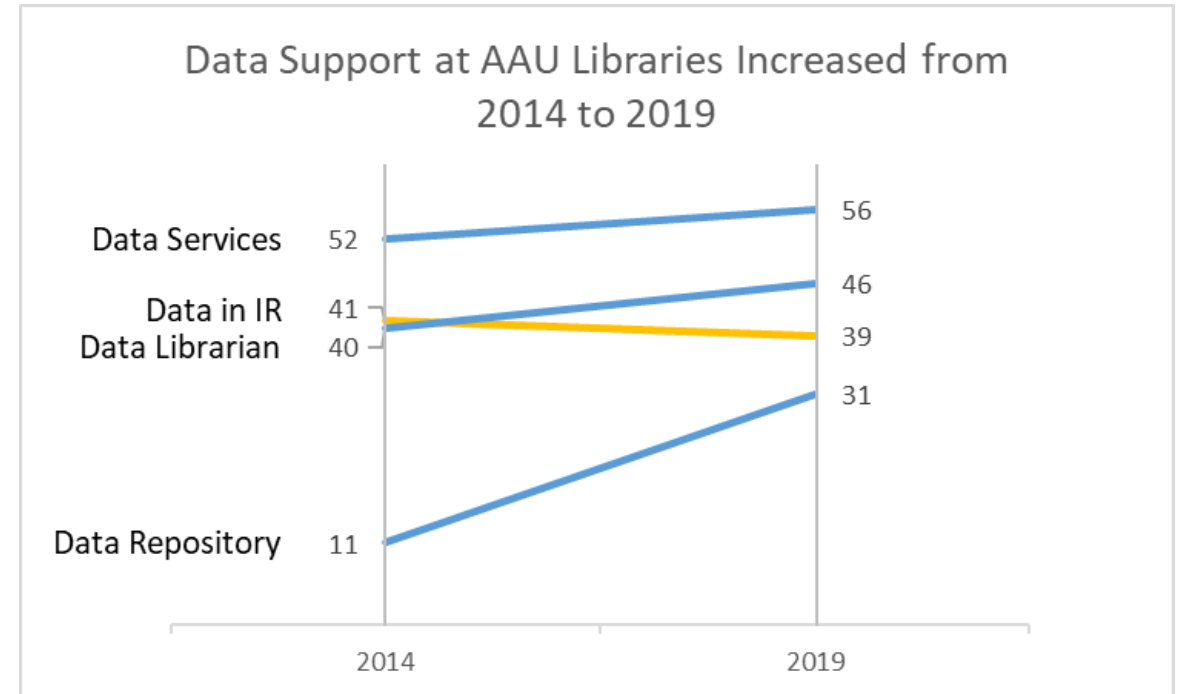
# Identify What is Important

- Decide which data to highlight
- Give your figure a helpful title



# Remove Chart Junk

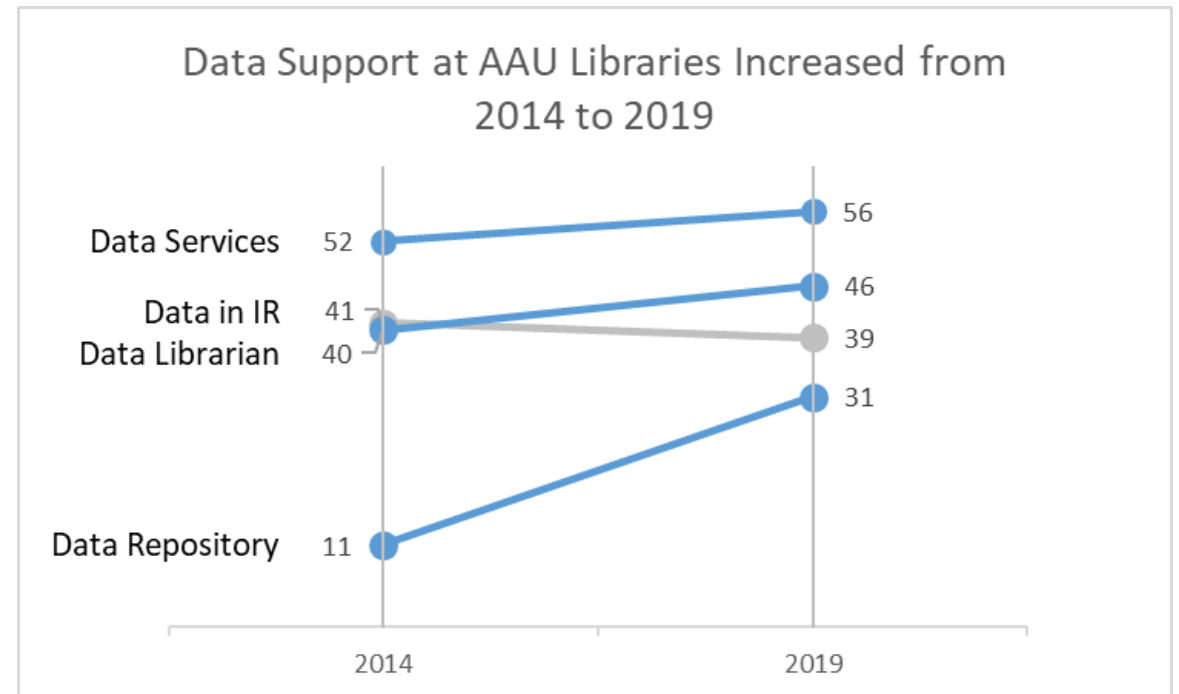
- Remove extraneous lines and numbers
- Label the data directly



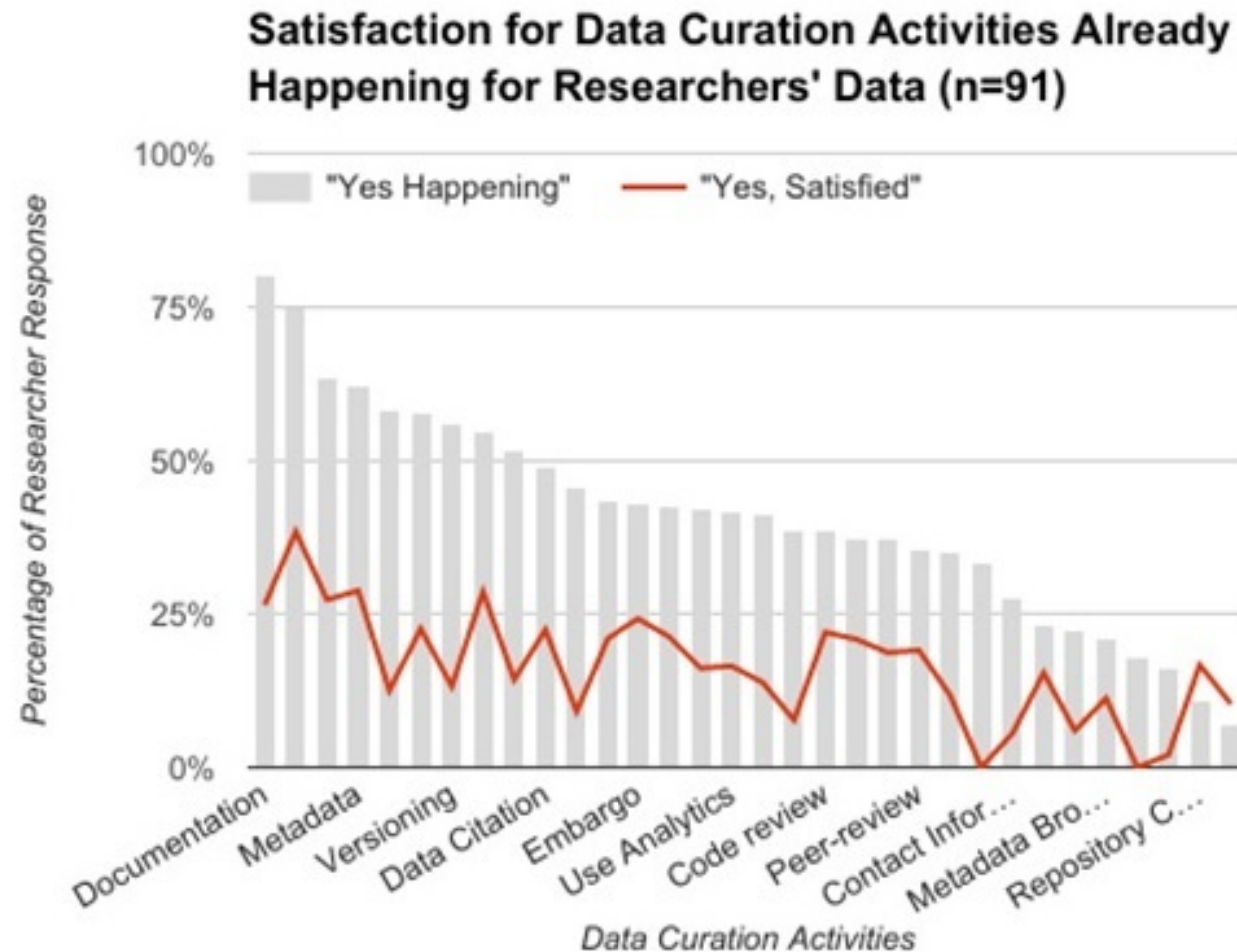


# Draw the Viewer's Eye

- Use color sparingly to highlight
  - Use grey for less important content
  - Avoid:
    - Pairing red and green (colorblind)
    - Pink for women and blue for men
  - Check: print in black and white
- Reorder your data, where possible

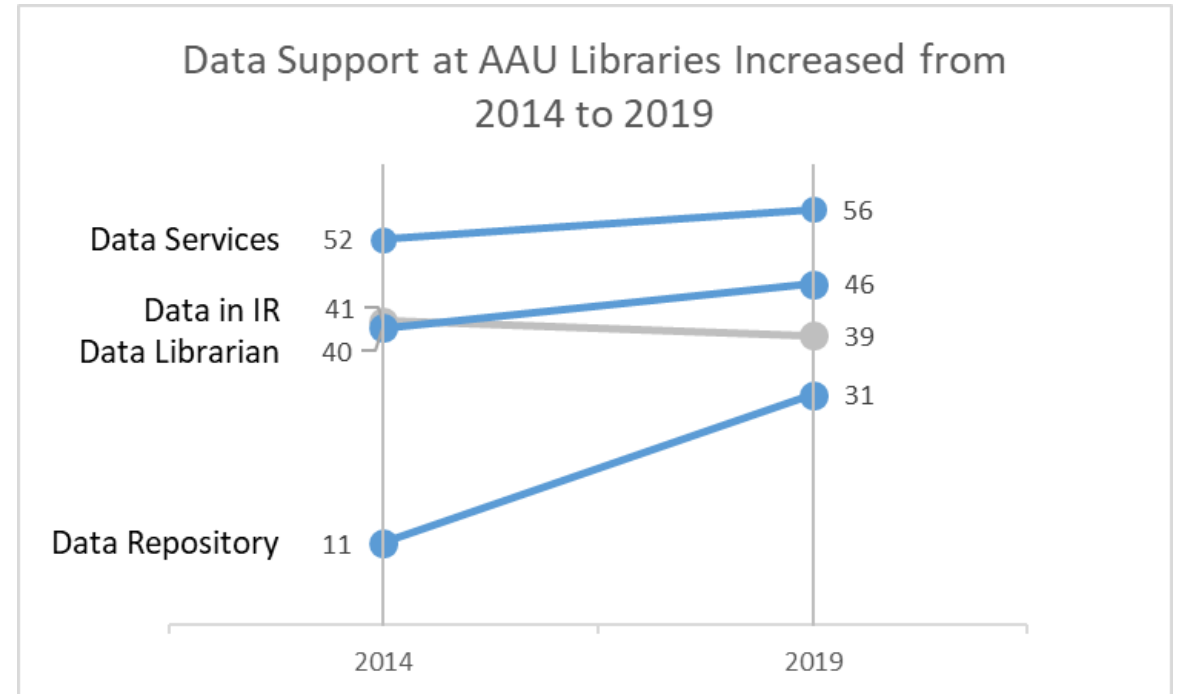


# Combo Chart



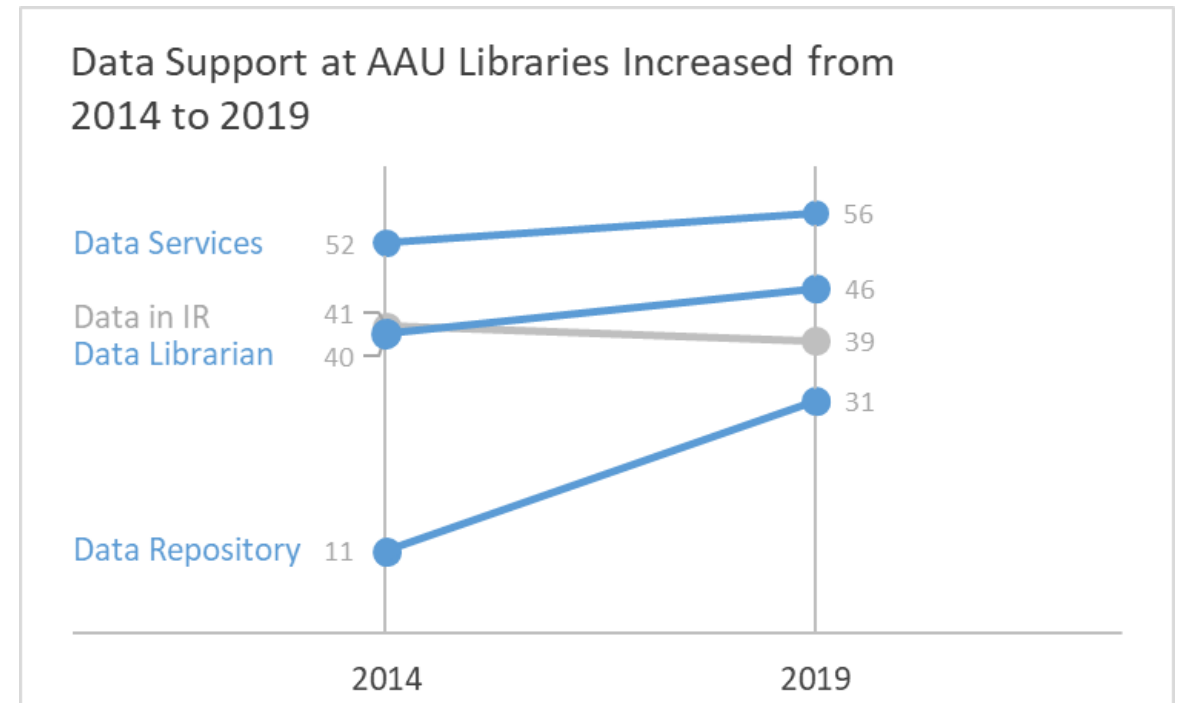
# Draw the Viewer's Eye

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  - Check: print in black and white
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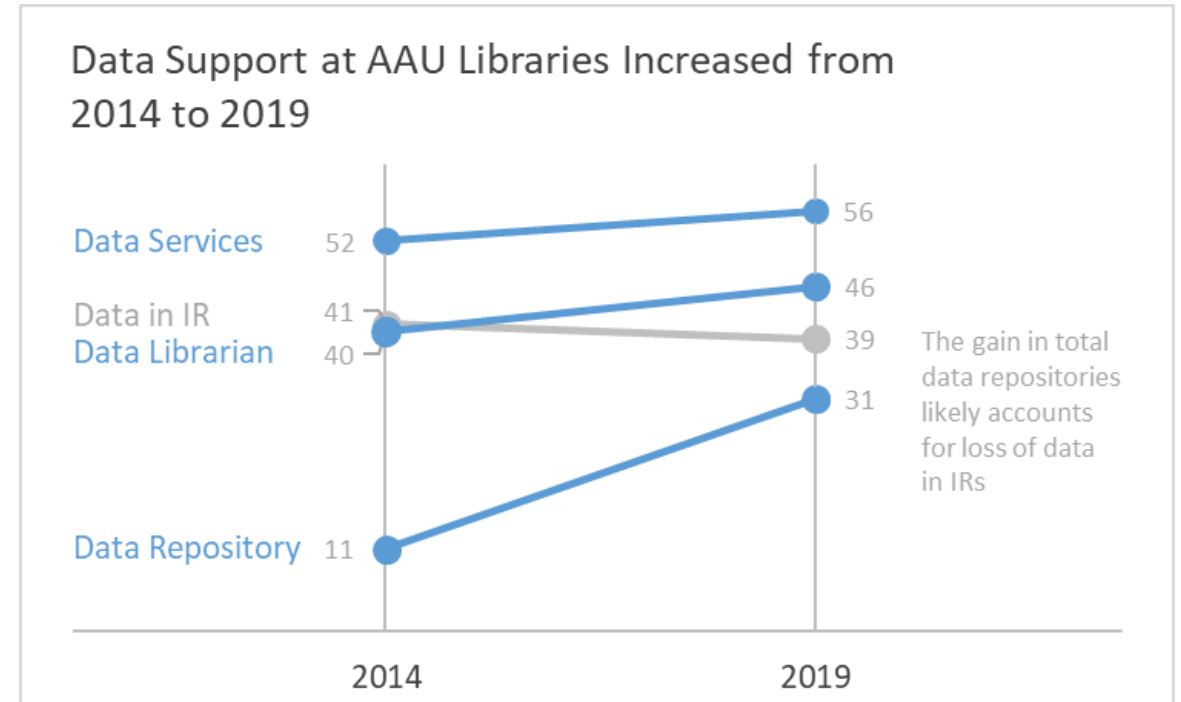
# Be Consistent

- Align content left or right
- Limit font types and sizes
- Limit color palette
- Make color assignment consistent across figures

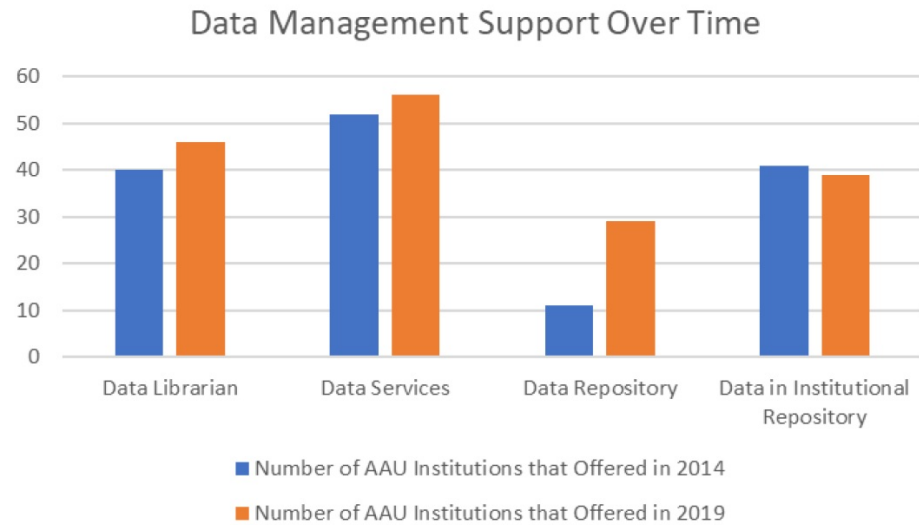


# One More Thing

- It's okay to annotate the data on the graph

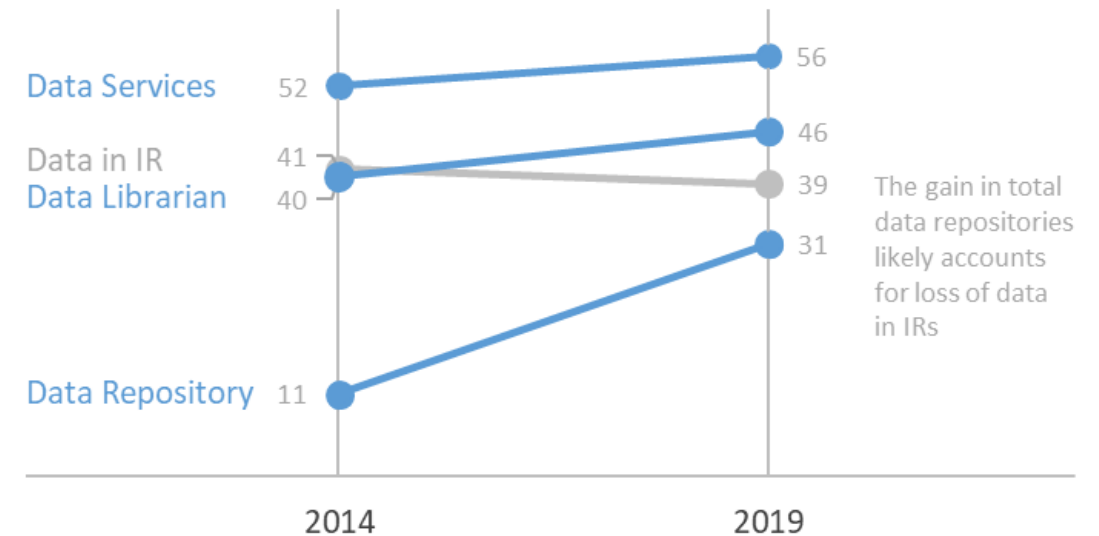


# Final Image



**Figure 1.** Data Staff and Service Comparison from 2014 to 2019

## Data Support at AAU Libraries Increased from 2014 to 2019

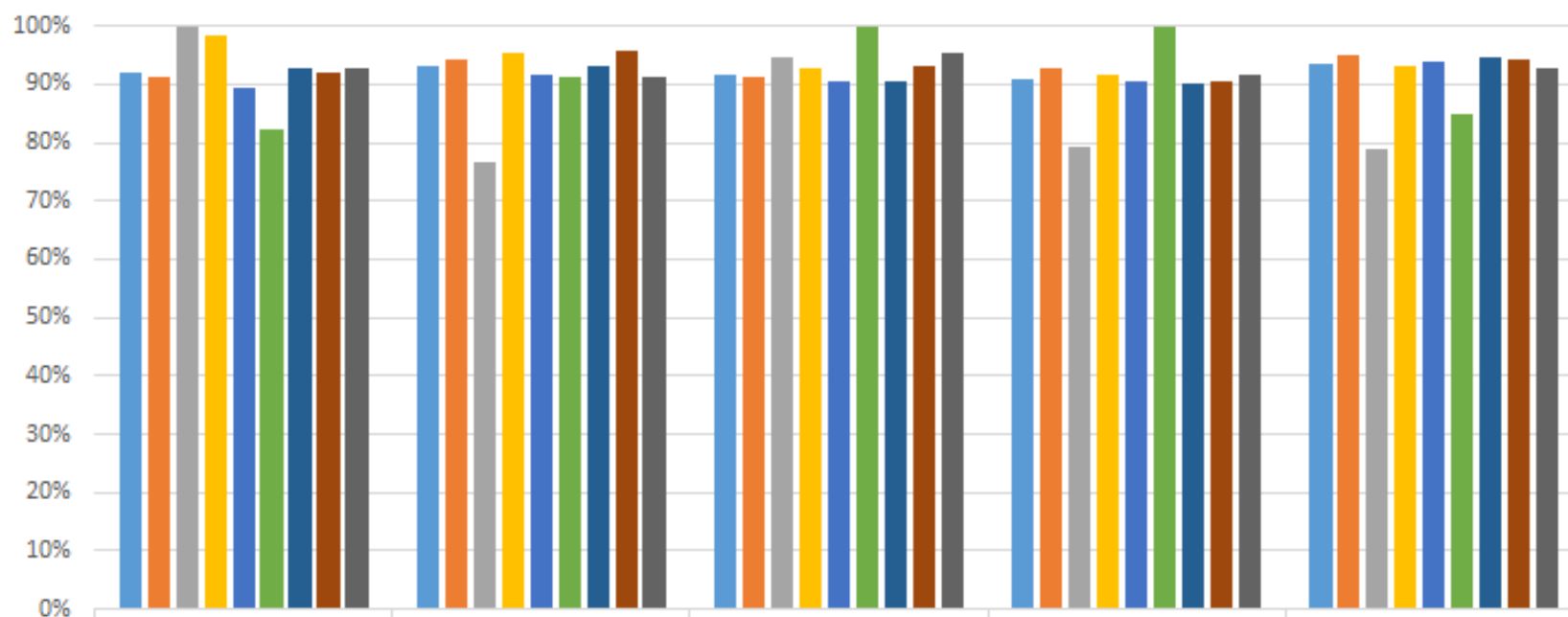


# Test Your Figures

- Take a break; see how you process the chart when you come back
- Show your figure to a friend and ask them to talk through what they see and understand

# Activity 2

Six Year Graduation Rates of Freshman Cohorts  
2006-2010



	2006	2007	2008	2009	2010
All Students	92%	93%	92%	90.8%	93.6%
Non URM	91%	94%	91%	92.6%	95.0%
URM*	100%	76%	94%	79.4%	78.9%
Female	98%	95%	93%	91.5%	93.1%
Male	89%	92%	91%	90.3%	94.0%
Pell Grant	82%	91%	100%	100.0%	85.0%
No Pell Grant	93%	93%	91%	90.3%	94.5%
5+ Caltech physics placement exam	92%	96%	93%	90.6%	94.3%
<5 Caltech physics placement exam	93%	91%	95%	91.7%	92.6%

A first-time freshman cohort includes those entering Caltech directly from high school with no prior academic history at an institution of higher learning.

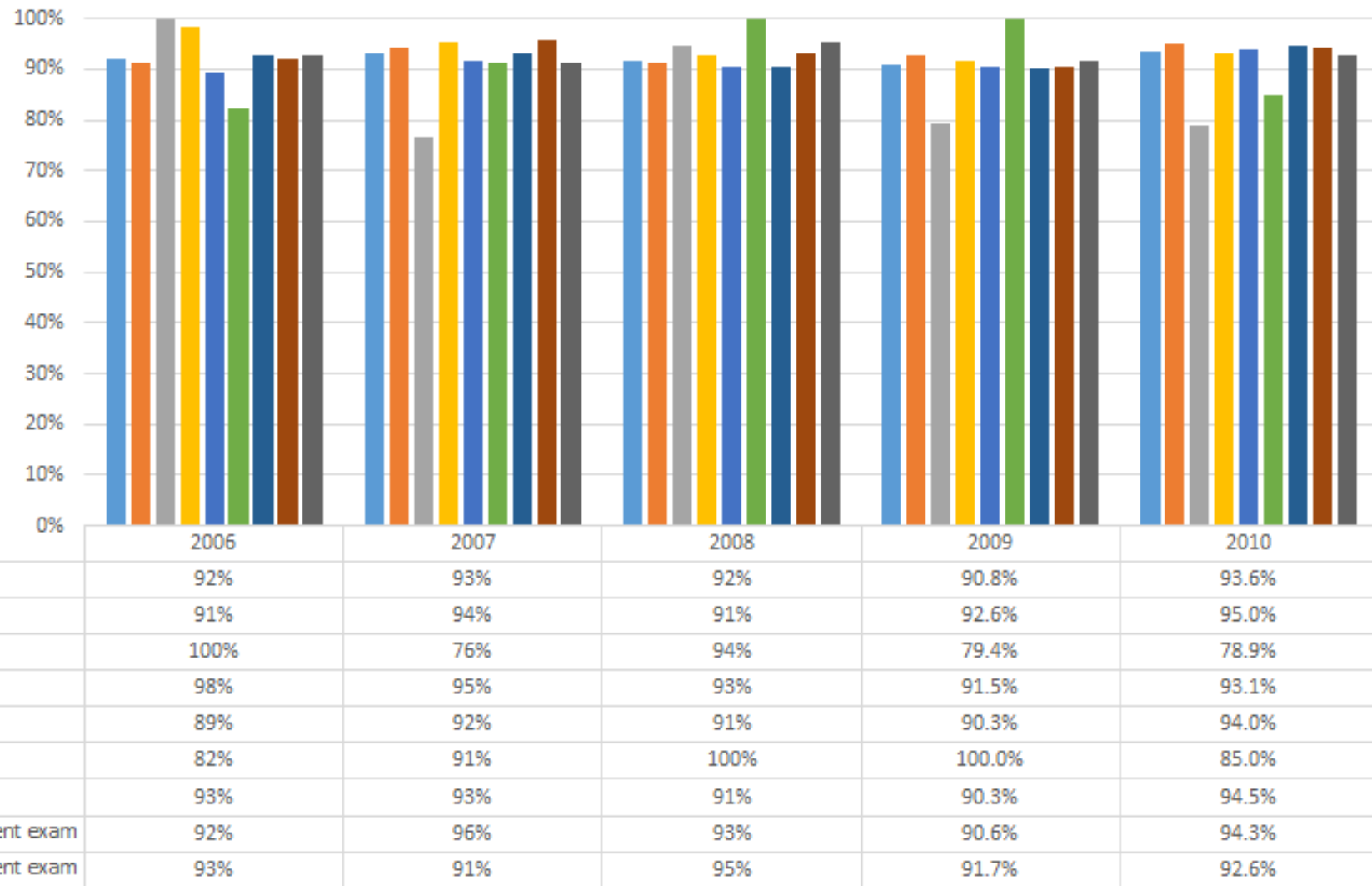
\*URM students are classified as "American Indian or Alaskan Native," "Black or African American," "Native Hawaiian or Other Pacific Islander," or "Hispanic" consistent with Integrated Postsecondary Education Data System categories



# Activity 2

1. What is your message?
2. What chart type?
3. What information is important?
4. What content should be suppressed?
5. How will you draw the viewer's eye?
6. What details do you need to make consistent?

Six Year Graduation Rates of Freshman Cohorts  
2006-2010



A first-time freshman cohort includes those entering Caltech directly from high school with no prior academic history at an institution of higher learning.

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# Further Reading

- Evergreen, S. (2016). *Effective data visualization: The right chart for the right data*. SAGE.
- Nussbaumer, K. C. (2015). *Storytelling with data: A data visualization guide for business professionals*. Wiley & Sons.
- Few, S. (2012). *Show me the numbers: Designing tables and graphs to enlighten*. Analytics Press.

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- Questions? Let me know at [briney@caltech.edu](mailto:briney@caltech.edu)